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ABSTRACT

The potentiality of macroanalysis of interactive dialogue was studied for ten suburban school teachers and their very high and very low ability student groups. Macroanalysis is the computerized analysis of interaction data into units of three or more tallies with the number of unit occurrences determinable. The sample groups had a mean IQ difference of 25 points. All class dialogues were coded according to Form Z of the Campbell-Rose Interaction System. Following an example of a 38-tally matrix in the Flanders Interaction Analysis Category System, macroanalyses of coded dialogues were compared with patterns determined by the Anidon and the Hall method. Results obtained showed that macropatterns corresponded more closely to the kind of observed teaching behavior. Macroanalysis proved simpler to understand and could readily be used as a feedback mechanism to neophyte teachers. Implications of macroanalysis for educational research, teacher preparation, and continuing education are given. (CC)

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PATTERN ANALYSIS - A MACROSCOPIC DEVELOPMENT FOR INTERACTION ANALYSIS

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MACROANALYSIS

A NEW DEVELOPMENT FOR INTERACTION ANALYSIS

Abstract: Macroanalysis is the process of analyzing interactive dialogue into units of three or more tallies. It is an attempt to view interactive dialogue in larger and larger units. It is the contention of this paper that Macroanalysis is the best interactive feedback mechanism yet developed, and represents another level of analysis for interactive data which should lead to new directions for research in this area. Macroanalysis is essentially a process which is easy to understand and use. For this reason it should help in the implementation and dissemination of interaction analysis.

Introduction: After a full decade of feverish research activity into teacher behavior and the effectiveness of various affective and cognitive methodologies, why has so little progress resulted? Furthermore, why has the implementation and dissemination of the underlying interactive theory proceeded so lethargically? The answer to both questions may well be related to the inadequacies of the much tauted interaction matrix. The matrix has been used as the primary vehecle for summarizing the sequenced interactive tallies. The focus of the research has been in isolating numerous ratios and areas within the matrix which discriminate among the many teaching methodologies. Unfortunately, matrix interpretation has always been tedious and, in many cases, unproductive. This is particularly true when attempting to feed back interactive information to teachers, interns, and student teachers. Invariably, the matrix stifles implementation and subsequent dissemination. It is simply too complex for widespread analysis and too confining for further research in the field. In an attempt to correct these deficiencies, Macroanalysis was developed.

Macroanalysis is a process of analyzing interactive data into units of three or more tallies. No matrices are utilized and all sequences involve nine or more seconds of dialogue. By contrast, the process involved in the construction of matrices from two-unit sequences has been defined as microanalysis. Microanalysis includes all observational systems which use the two-tally sequencing unit and consequently, includes all systems using interaction analysis. These systems reduce teacher and student dialogue into very small units of analysis, while Macroanalysis orders the data into larger and larger units of analysis. Microanalysis is analogous to electronmicroscopy, while Macroanalysis can be compared to the high and low power of the ordinary microscope. Historically, the cell theory, developed initially from a macroscopic analysis and proceeded as refinements in technology, produced more and more information about smaller and smaller intracellular units. Observational research proceeded in the opposite direction. In simple terms, the problem with microanalytical research is that it has led to a concentration on too limited a field. The analyses have been so fragmented that they have been difficult to reassemble. The problem is similar to the astronomer's problem of determining the structure of our own universe from deep within the system. In this case many discrete units of information are available, but assembly of this data into a global picture has been a monumental task.

Definition: The Macroanalysis process involves a computerized program which scans the total array of interactive tallies and isolates all existing groups of tallies. These groups of tallies involve sequences of three, four, or five units and are referred to as "patterns." Macroanalysis not only isolates all existing patterns but also the number of occurrences and the percentage each pattern occurs. The dominant patterns become the focus of interest. These patterns are in no way derived from any matrix analysis and consequently, involve no inferences about the data. The process is a descriptive one which simply involves tabulating the number and kind of different patterns which do exist in the total array of interactive data.

Background: The field of microanalysis may be traced to H. H. Anderson and his pioneering studies (1945-46) on the function of primary school teachers' dominative and integrative behaviors. These two behavioral dimensions were the products of his twenty-three category system. This system of analysis proved to be an effective tool for the observation of classroom dialogue. Anderson's studies utilized the first interactive ratio, the dominative/integrative ratio, in determining the interactive role played by teachers and students. John Withall (1951) refined Anderson's system into a seven-category system which was entitled a "Social-Emotional Climate Index." This system was considerably more useful in the observational analysis of classroom dialogue and contained two important dimensions (learner-centered and teacher-centered). The system is still widely used as a research instrument. Ned A. Flanders further refined elements of both the Anderson and the Withall systems and developed the

"Flanders Interaction Analysis Category (FIAC) System." The FIAC System contains four dimensions: indirect teacher behavior, direct teacher behavior, student behavior, silence or confusion. This ten-category system enjoyed the greatest popularity and the most widespread use. The FIAC System refined the mechanism of collecting data so that coded tallies could be recorded in a systematic manner. Flanders also was the first to sequence all the interactive tallies in pairs so that they could be placed in two-by-two contingency matrices. This mechanism of summarizing the data enabled researchers to determine what behaviors preceded or followed one another. The matrix also proved very useful in deriving a set of interactive ratios which have been used to identify numerous subdimensions of the teaching process. The FIAC System has been used in over 250 doctoral studies in the time period from 1967-1972 and in numerous research studies at various grade levels and in a wide variety of settings. It has also served as a model for the development of numerous observational systems in the field (Simon and Boyer, 1970). Despite its widespread use, problems have persisted with this system. Many researchers have subscripted the FIAC in an attempt to further refine the complexities involved in classroom process. In many cases these expanded systems utilize twenty or thirty categories and therefore use larger and larger matrices. The original FIAC matrix produced 100 cells, while the larger subscripted systems produced 400-900 cells. In most cases the majority of the matrix cells contain no data and consequently, the matrices from the larger systems have become less and less useful. As mentioned above, the sequencing has also limited all analysis to very small microunits which have proved to be too constricting for analysis. The matrix itself, though an elegant mechanism for summarizing data, has proved in many cases to be too complex both for understanding the coded events and, more significantly, for feeding back information to teachers, interns, and student teachers.

Pattern Analysis and Macroanalysis: In recognition of this problem, several researchers began to suggest mechanisms for avoiding the all too limiting sequencing unit used to construct the matrices. Campbell and Barnes (1969) suggested utilizing a series of three-, four-, and five-category combination matrices. Unfortunately, this suggestion would only compound the problem by producing matrices with thousands of cells. The majority of these cells would be vacant, and the total array of cells would be beyond comprehension.

Amidon and Amidon (1967) suggested another solution involving a mechanism for inferring larger teaching patterns from the matrices. Hall (1969) used a similar mechanism in his "Instrument for Analysis of Science Teaching" and provided some normative teaching patterns which he called "primary and secondary tactics." Bosch (1972) utilized Amidon's

"Pattern Analysis" to determine the dominant patterns in four distinct interaction analysis studies.

Two other studies utilized teaching patterns: Evans (1969) determined the "functional patterns" of kindergarten teachers, and DeLucia (1971) developed "program extract" which attempted to extract various teaching patterns from matrix data. In all cases patterns were derived from matrix data. In order to appreciate the difficulties involved in this process, let us illustrate how a matrix is constructed.

Figure 1 illustrates a set of thirty-eight FIAC tallies which were tabulated every three seconds. This figure also contains the completed FIAC matrix for this data. Each of these tallies is paired twice; first as a consequent of the tally preceding it, and then with the tally following it. Thus the 10-4 combination is recorded in the matrix by selecting the intersection between the tenth row and the fourth column. A tally is placed in this cell (10-4). Likewise, the 4-8 combination is recorded in the 4-8 cell of the matrix (Row 4 - Column 8). The next combination involves 8 as the antecedent and 3 as the consequent (8-3). All tallies are therefore entered into the matrix in this manner. In our example a total of thirty-eight tallies representing 114 seconds of dialogue have been inserted in the matrix. Once the matrix is completed we may apply Amidon's pattern analysis. The first step in this process involves discounting the steady-state cells. A steady-state cell is identified by repeating any category twice in succession. Thus the following cells are considered steady-state cells: 1-1, 2-2, 3-3, 4-4, 5-5, 6-6, 7-7, 8-8, 9-9, 10-10. These cells represent a degree of continuity in the dialogue. The remaining ninety cells are known as transition cells. The next step involves the selection of the transition cell with the highest frequency. In our example the 3-4 cell has the greatest number of tallies. The next step involves going to the row of the second digit of this cell and selecting the transition cell with the highest frequency. This cell must have at least one-half the number of tallies of the primary cell in order to qualify. In our example the 4-8 cell satisfies this requirement. These two cells are now connected to signify a behavioral relationship between them. This process is continued until no further cells can be added. In our example the 4-8 cell was followed by the 8-3 cell to terminate the pattern. The three cells involved in this pattern are 3-4 4-8 8-3. The two connecting arrows and their accompanying transition cells signify "moves." A pattern is defined by Amidon as "two or more moves." We may abbreviate this pattern to be 3-4-8-3. Minor patterns and steady state cells may also be added into the analysis, but these additions overly complicate the patterns. Is this process valid? Can inferences involving sequences of three, four, or five tallies be derived from data sequenced in units of two? On logical grounds alone it is obvious that intervening tallies would invariably invalidate the process.

There are no assurances that moves are really connected. In our example the 4-8 move must necessarily lead to the 8-3 cell since no other tallies were tabulated in the row. This is not the case with the first move, 3-4, since it placed us in the fourth row where the data was distributed among five cells. Surprisingly, not a single instance of 3-4-8-3 occurred in spite of the fact that this was designated the "major pattern"! Macroanalysis (refer to Figure 2) showed 4-8-3 to be the dominant three-tally pattern, while 3-4-3-4 and six other patterns predominated among the four-tally patterns. The Macroanalysis output totaled 28 three-tally patterns and 33 four-tally patterns. Again, it is important to emphasize that Amidon's major pattern for this example, 3-4-8-3, was an artifact and did not exist in the data. This type of distortion arises when patterns are derived from matrices.

The Macroanalysis patterns actually do exist. The two most dominant three-tally patterns account for 28 per cent of all the three-tally patterns. The four-tally patterns indicated seven patterns dominating. Macroanalysis does produce quantitative tabulations for the full array of existing patterns. Amidon's process produces qualitative patterns which, in some cases, do not correspond to the data. Another important feature is that steady-state cells are included in the Macroanalysis process while the Amidon process excludes them. This is an unfortunate omission since these cells usually contain more than 60 per cent of all the interactive data. No process can exclude so much data and still be expected to be productive. In our example 7 of the 28 three-tally patterns contained steady-state cells, while 15 of the 33 four-tally patterns contained these cells. When larger accumulations of data are analyzed, these percentages rise sharply. Is the Amidon method of pattern analysis valid for larger samples of data? Obviously, it was invalid for our example. To answer this question a sample of ten teachers was coded and analyzed according to both processes. The results shown in Figure 3 illustrate the patterns of ten teachers with very high and very low ability groups. The mean IQ of the high classes was 114.70; for the low classes 89.50. This set of twenty patterns shows that the three-category patterns derived from Amidon's analysis did show approximately a 50 per cent correspondence with reality. In Figure 3, Column 4, the number of occurrences of the Amidon patterns is shown. Column 5 shows the percentage of occurrence of the pattern in relation to the total array of patterns. In addition, the Macroanalysis process ranks by order of occurrence the fifty predominant patterns. If a pattern occurs infrequently, it is not included in this ranking. These data are shown in Column 6. An examination of the data tabulated in this figure shows that in one case Amidon's pattern analysis yielded no results. This occurred with the high ability group of Teacher 6. This nonfinding occurred frequently whenever a good number of matrices were analyzed. Another chronic problem arising from deriving patterns from matrices is the tabulation of very long sequences of tallies which have little correspondence to reality. In this study four of twenty patterns contained such long sequences. In the case of the high group of Teacher 8, the pattern was found to be 6-8-3-5-9-3-4-8-7-10-6. No existing pattern was found in the data; in fact, even the first five moves were found to be inva

The Macroanalysis process revealed that the mean number of occurrences for the most dominant three-tally patterns was 409, for four-tally patterns it was 344, and for five tally patterns it was 299. The highest number of occurrences for any of the Amidon patterns was seventy-six for the low ability group of Teacher 3. This tabulation was one of the nine Amidon patterns which could be ranked among the top fifty patterns. The Amidon patterns which produced three-tally patterns proved the most valid with a mean number of occurrences at forty-one. The Amidon four-tally patterns had a mean of twenty occurrences, and the mean of the 10 five-tally patterns was only one occurrence per pattern. These patterns were largely invalid. In fact, four of these patterns were artifacts with no correspondence to existing patterns. None of these five category patterns was ranked even in the top fifty patterns. Not a single Amidon pattern approached the number of occurrences tabulated for the most frequently occurring Macroanalysis pattern.

Amidon qualifies different types of patterns by defining a "teaching pattern" as a transaction involving a teacher-student-teacher sequence. In Figure 3 we have identified the six patterns which satisfy this definition and labeled them "TP." Again, only half of these were valid.

The Hall system of extracting patterns does not contain the steady-state qualification and also recommends the addition of all the cells utilized to gain some idea of the percentages of tallies represented by the "primary or secondary tactics." Unfortunately, the Hall process also extrapolates beyond the data and suffers from many of the same drawbacks as the Amidon system. The Hall process does not utilize any limitation in selecting the various moves so that five-tally patterns invariably result. Again, all the patterns identified by the Hall process have been compared with the patterns derived from Macroanalysis (refer to Figure 4). The highest number of occurrences for any of these patterns is sixteen. Unfortunately, seventeen out of the twenty patterns do not occur in the first fifty patterns. Most are largely invalid. In fact, two of these patterns contain no occurrences and are simply artifacts. The problems encountered in projecting patterns from either the Hall or Amidon mechanisms are insurmountable. Researchers simply cannot construct three-, four-, and five-tally patterns from two-tally data. The major threat to such a process involves the validity of the inferences. A 50 per cent validity rate is too crude for use in research. The long-awaited second level of interactive analysis simply cannot be adequately derived from within the confines of the matrix. It can only be provided from a totally new direction. Macroanalysis does appear to answer such a call.

Description of Ability Group Study: In order to illustrate the potentiality of Macroanalysis let us summarize some of the findings from the Campbell ability group study cited above. The highest and lowest ability groups of ten teachers in a suburban school were analyzed according to a three-, four-, and five-tally Macroanalysis. The classes involved the most accelerated and the slowest groups in the school. The mean IQ difference was twenty-five points, while the chronological age difference was negligible (13.79 years for the low ability group; 13.59 years for the high ability group). Teachers were selected who taught both extremes in the ability range. All class dialogue was coded according to Form 4 of the Campbell-Rose Interaction System (CRIS). CRIS is a subscripted Flanders instrument with a research form, a secondary school form, an elementary school form, and a teacher training form. Computer programs have been developed to yield the large 29 x 29 CRIS matrices and thirty-three interpretative ratios in addition to the FIAC 10 x 10 matrices and eighteen accompanying ratios. A mean of 2,40[illegible] tallies was tabulated for each class. This cumulation represents over 120 minutes of coded dialogue. Macroanalyses were performed for each class and again by summing the interactive data for all low ability and high ability classes. The high ability group had 24,901 tallies, while the low ability group had 24,154 tallies. The Macroanalysis programs yield the dominant patterns, the number of different patterns occurring, and the frequencies and total frequencies involved for each of the twenty-nine categories. In addition, the most dominant indirect and direct patterns are derived, and an over-all ranking of the top fifty patterns is calculated. Macroanalysis can be similarly adapted to any observational system involving any number of categories. The computer is able to complete the analysis in a matter of microseconds, and the total cost for our analyses has been negligible.

Results: The output of the Macroanalysis process indicated that teachers used a mean number of 539 three-tally patterns, 913 four-tally patterns, and 1,208 five-tally patterns. If we compare these means to the maximum possible number of patterns, it is evident that teachers utilize only a small fraction of the full range of behavioral sequences. As the patterns increase from three tallies, to four, and to five tallies, the maximum number of patterns possible rises exponentially, while the number of patterns which actually do occur seems to increase at a more arithmetic rate (refer to Figure 5). The amount of similarity in patterns for all groups is striking. Certainly, more variety would have been expected. If we examine the ten teachers together in the low ability or high ability groups, we find that as a group they utilize only 11 per cent of the maximum number of different three-tally patterns possible; for four-tally patterns they use only .95 per cent; and for the five-tally patterns they use only .054 per cent. Teachers' sequences do not seem to vary from class to class. Perhaps this finding helps substantiate the chronic boredom reported by youngsters in our junior high schools. It will be interesting to compare the array of patterns which exist at elementary and high school levels. The patterns of the two groups were compared statistically by the nonparametric "Test for Significance of Difference between Two Proportions" (Bruning and Kintz, 1968). The results of these tests are shown in Figure 6. The high ability groups experienced more wait time following the teacher question, more silence, more indirect behavior, more questions, more student-initiated behavior, and more use of the teacher's opinion.

The low groups experienced more confusion, more teacher rejection, and more low-level student response. When the fifty most dominant patterns of both groups were examined, both groups were found to have thirty-three identical patterns. Both had the same three most dominant patterns. Differences did occur between the groups, but these findings parallel the statistical data cited in Figure 6. One finding which became evident in this dominant pattern data was the predominance of patterns containing steady-state cells. The three most dominant patterns for each group contained these cells. Furthermore, the high group was found to have steady-state cells in forty-two out of the top fifty patterns. The low group was found to have steady-state cells in thirty-eight of the top fifty patterns for the group. The top ten patterns for the high group and the top nine patterns for the low group all contained steady-state cells.

In terms of indirectness, the teacher's use of the student ideas was found in sixteen of the top fifty patterns for the high group and ten out of the first fifty for the low group. For the high group, the extended teacher's use of student ideas through inferences ranked twelfth and was not found for the low group. Direct teacher patterns predominated in the low ability group with seven of the top fifty patterns containing the teacher's rejection behaviors. The high ability group had only two of the dominant fifty patterns in the rejection area and one of these involved the extended rejection of ideas with reasons.

Many of the pattern differences between the groups represent simple permutations of largely congruent patterns. All in all, the differences between the two ability groups are greater for the volume of patterns than for the number of different patterns. Teachers appear to attempt to use the same standard set of patterns regardless of the extreme differences in the groups, but the interactive responsiveness of the groups causes them to emphasize specific sets of patterns with the high group and certain other sets of patterns for the low ability groups. Thus indirect teacher patterns are evident in the low ability groups, but the disciplinary behaviors involved with the rejection of behavior are emphasized. Likewise, divergent and evaluative teacher questions and student-initiated patterns are evident in these groups, but they do not gain the dominance they do in the high ability groups. The total behavioral repertoire of these teachers is surprisingly limited in relation to the maximum possible variety, and it appeared that teachers emphasize specific segments of their repertoire to meet specific needs. The net statistical effect is that the methodology used in both groups is significantly different; however, in many cases the dominant pattern of the high group is simply used less frequently in the low group.

Implications: The development of Macroanalysis has many important implications:

1. Teacher Preparation. Although microanalysis has been widely used in preparing teachers, several inadequacies and limitations have become evident. The main problem involves the difficulty in observing the fast-moving teaching process in terms of the small three- or six-second microunits. Such

small units of analysis are not only difficult to observe but even more difficult to use in microteaching or in the development of strategies and tactics. Teaching proceeds macroscopically rather than in the short discrete units. It occurs in much longer sequences. The microunit limitation is primarily responsible for the failure of interaction analysis to make an impact on supervision. Microunits are poor feedback units. In contrast, the Macroanalysis patterns are considerably easier to understand and use. They should lend themselves to use in microteaching or in developing models of teacher behavior. The macropatterns also represent excellent units for feeding back interactive information to the neophyte teacher. Supervisors will find the pattern a useful device at all stages of student or intern teaching.

2. Research. Microanalysis research has been a productive area of educational research. In this context the various observational category systems have been used as both an independent and dependent variable. The independent variable research involves specific interactive climates and their relation to achievement or attitude development. The dependent variable research has involved using the observational instruments as a means of measuring the effectiveness of other variables. Currently much of the research effort has shifted toward using microanalysis as a dependent variable. This development is certainly premature since few of the findings of the

independent variable research have been firmly established. It is the contention of this paper that further descriptive analyses should be undertaken before interaction analysis becomes widely used as one of the evaluation tools for educational research. Macroanalysis could serve as a stimulus for further descriptive research. Perhaps a new round of such research is needed to determine those patterns which are currently used by teachers at various grade levels. What patterns are most effective? Does a wide variety of patterns prove more effective than the use of a smaller number of productive patterns? What is the effect of doubling the use of a specific pattern? In all cases, Macroanalysis will help define the methodology more precisely. Macroanalysis will also be more adaptable to role playing or modeling studies.

Macroanalysis should also lead to a number of research studies into new areas such as the establishment of the decay curves involved with the longer patterns. Our analysis of the three-, four-, and five-tally patterns shows that certain extended patterns persist for six, nine, or twelve seconds, but in each case the number of occurrences decreases with longer periods of time. For some sequences a certain stability results; for others a rapid decay into other categories results. In all cases some degree of variability is experienced with each new set of longer tallies. Are longer more stable patterns more effective? Is there a relationship between teacher productivity and the rates of decay of longer and longer patterns? Can such decay curves be incorporated into the field of information processing? All these questions may lead to productive research in this area.

3. Continuing Education. Microanalysis has been used successfully on a small scale in the in-service training of teachers, but its effect has been limited due to its complexity. The matrix is responsible for much of this difficulty. Microanalysis has also been used to a limited degree in the supervision of teachers. Again, its limitations as a feedback mechanism has underminded its usefulness in this area.

Macroanalysis should help in the efforts to implement and disseminate interactive theory. Macropatterns correspond more closely to the kind of teaching behavior most teachers utilize. They are simple to understand and can readily be used to feed back significant doses of information. Certainly it is easier to show a teacher his top ten patterns than it is to overwhelm him with a matrix containing hundreds of tallies in innumerable areas or cells. It is likewise easier for the teacher to use a limited number of patterns than to attempt to artificially force his teaching behavior to microunits.

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FIGURE 1

FIAC CODED TALLIES AND ACCOMPANYING FIAC MATRIX

10-4-8 - 3-5 - 5-5 -4-8-3-5-5-5-4-4-8-3

4-4-8-3-4-3-4-3-9-3-4-4-9-3-4-8-3-4-3-4-10

Second Member of Pair

Category	1	2	3	4	5	6	7	8	9	10	Total
1											
2											
3				7	2				1		10
4			3	3				5	1	1	13
5				2	4						6
6											
7											
8			5								5
9			2								2
10				1							
Total			10	13	6			5	2	1	37
%											

First Member of Pair

3-4 → 4-8 → 8-3

Closed

3-4-8-3-

Abbreviated

FIGURE 2

MACROANALYSIS PATTERNS

3 Tally Patterns			4 Tally Patterns		
Dominant Pattern	Number of Occurrances	Percentage	Dominant Pattern	Number of Occurrances	Percentage
4-8-3	5	17.8	3-4-3-4	2	
3-4-3	3	10.7	3-5-5-5	2	
3-4-4	2	7.15	4-4-8-3	2	
4-3-4	2	7.15	4-8-3-4	2	
4-4-8	2	7.15	4-8-3-5	2	
8-3-4	2	7.15	5-5-5-4	2	
8-3-5	2	7.15	8-3-5-5	2	
9-3-4	2	7.15	Other Patterns	19	
Other Patterns	8		Totals	33	100.00
Totals	28	100.00			

FIGURE 3

COMPARISON OF AMIDON'S TEACHER-STUDENT PATTERNS AND CORRESPONDING MACROANALYSIS PATTERNS

Teacher	Group	Amidon's Major Pattern	Macroanalysis Patterns: Number of Occurrances	Macroanalysis Patterns: Percentage of all Patterns	Macroanalysis Patterns: Rank Order of Patterns
1	High IQ	9-3-9-10-9	1	.150	---
1	Low IQ	9-3-9-10	3	.1668	---
2	High IQ	9-3-9	35	1.30	6th
2	Low IQ	8-7-8-10-7	1	---	---
3	High IQ	10-4-10-9-3	0	---	-
3	Low IQ	8-7-8	76	3.00	3rd
4	High IQ	4-8-3-4 TP*	27	1.000	5th
4	Low IQ	4-8-3-5-9 TP*	1	---	---
5	High IQ	9-3-9	35	1.000	9th
5	Low IQ	4-8-3 TP*	59	3.000	4th
6	High IQ	none	--	---	---
6	Low IQ	8-3-5-4-8	2	.07056	---
7	High IQ	8-3-5-4-8	0	0	0
7	Low IQ	8-3-4-8	13	.4000	18th
8	High IQ	6-8-3-5-4 TP*	0	0	0
8	Low IQ	10-9-3	18	.5555	25th
9	High IQ	8-3-4-8	37	1.6	4th
9	Low IQ	10-6-10-7-10	0	---	---
10	High IQ	5-9-5 TP*	26	1.00	6th
10	Low IQ	9-3-5-9-5-4 TP*	3	.1005	---

*TP = Teaching Pattern

FIGURE 4

COMPARISON OF HALL'S PRIMARY TACTICS

and

CORRESPONDING MACROANALYSIS PATTERNS

			Macroanalysis Patterns		
Teacher	Group	Hall's Primary Tactics	Number of Occurrances	Percentage of all Patterns	Rank Order of Patterns
1	High IQ	9-9-3-9-10	4	.1741	---
1	Low IQ	10-10-9-9-3	1	.0556	---
2	High IQ	10-10-9-9-3	1	.0399	---
2	Low IQ	8-8-7-8-10	5	.4545	27th
3	High IQ	10-10-4-4-10	1	.0440	---
3	Low IQ	8-8-7-8-6	3	.1277	---
4	High IQ	5-5-9-9-3	4	.1433	---
4	Low IQ	5-5-4-4-8	7	.2734	29th
5	High IQ	5-5-4-4-8	2	.0648	---
5	Low IQ	5-5-10-10-6	1	.0446	---
6	High IQ	5-5-4-4-8	0	-----	---
6	Low IQ	5-5-4-4-9	3	.1058	---
7	High IQ	5-5-4-4-8	2	.0875	---
7	Low IQ	10-10-6-6-10	0	-----	---
8	High IQ	8-8-3-5-5	3	.1372	---
8	Low IQ	10-10-9-9-3	2	.0617	---
9	High IQ	5-5-4-8-3	16	.6785	5th
9	Low IQ	10-10-5-5-10	2	.0951	---
10	High IQ	5-5-9-9-5	3	.0991	---
10	Low IQ	5-5-9-9-3	5	.1676	---

FIGURE 5

MACROANALYSIS PATTERNS

Sequencing Unit	Maximum Possible Number of Units		Actual Number of Units Utilized			
	FIAC - 10 Category System	CRIS - 28 Category System	Mean No. Patterns per Teacher	Percent of Max.	Mean No. Patterns for 10 Teachers* (As a Group)	Percent of Max.
2	100	784				
3	1000	21,952	539	2.46%	2465	11.3%
4	10,000	614,656	913	.15%	5826	.95%
5	100,000	17,210,368	1208	.007%	9297	.054

*Some Teachers use different patterns.

FIGURE 6

DOMINANT PATTERNS

<table>
<tr><th colspan="2">High Ability Group Patterns*</th><th colspan="2">Low Ability Group Patterns*</th></tr>
<tr><th>Greater Volume and Greater Variety of Different Patterns</th><th>Greater Volume</th><th>Greater Volume and Greater Variety of Different Patterns</th><th>Greater Volume</th></tr>
<tr><td rowspan="3">1. Teacher's use of students ideas with generalizations.
2. Teacher's indirect or clarification questions.
3. Teacher's divergent and evaluative questions.
4. Student initiated divergent and evaluative talk.
5. Total wait-time.
6. Wait-time following teacher's cognitive memory and convergent questions.
7. Wait-time following teacher's divergent and evaluative questions.</td><td rowspan="3">1. Silence.
2. Teacher's use of students ideas by repetition and through inferences.
3. Teacher's cognitive memory and convergent questions.
4. Teacher's opinion.
5. Student initiated cognitive memory and convergent talk.</td><td>1. Non-productive confusion.</td><td>1. Productive Confusion.
2. Teacher's rejection of ideas and behavior.
3. Low level student response.</td></tr>
<tr><th colspan="2">Non-significant Patterns</th></tr>
<tr><td colspan="2">1. Teachers use of praise and encouragement.
2. Teachers use of directions.
3. Wait-time following student talk.</td></tr>
</table>

*All values exceed the .05 level of significance.